

General

Guideline Title

AARC clinical practice guideline. Surfactant replacement therapy: 2013.

Bibliographic Source(s)

Walsh BK, Daigle B, Diblasi RM, Restrepo RD. AARC clinical practice guideline. Surfactant replacement therapy: 2013. *Respir Care*. 2013 Feb;58(2):367-75. [90 references] [PubMed](#)

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: American Association for Respiratory Care (AARC). AARC clinical practice guideline. Surfactant replacement therapy. *Respir Care*. 1994 Aug;39(8):824-9. [62 references]

Recommendations

Major Recommendations

The levels of evidence (grade A-D) and the strength of the recommendations (level 1-2) are defined at the end of the "Major Recommendations" field. The words "recommended" and "suggested" are used to reflect the strength of the recommendation, as level 1 and level 2, respectively.

Description/Definition

Endogenous surfactant is a biochemical compound composed of phospholipids, neutral lipids, and proteins that forms a layer between the terminal airways/alveolar surfaces and the alveolar gas. In 1961, Klaus and colleagues were the first to isolate alveolar surfactant from bovine lungs, and extracted a phospholipid fraction that displayed a surface active behavior. Ten years later, Gluck et al discovered a technique that allows fetal lung maturity to be measured using the lecithin/sphingomyelin ratio in amniotic fluid. Surfactant is secreted by the type-II pneumocyte and functions to reduce lung collapse during end-exhalation by decreasing surface tension within the terminal airways and alveoli. Infants who are born prematurely are more likely to have lungs that are surfactant-deficient at birth. Surfactant deficiency is associated with onset of respiratory distress syndrome (RDS), a major cause of morbidity and mortality in premature infants. Surfactant is also effective in treating infants with meconium aspiration syndrome (MAS), pulmonary hemorrhage and pneumonia, although the evidence base for their use in these disease processes is much weaker than the primary indication of RDS. Surfactant reduces surface tension, improves lung compliance, and stabilizes lung volumes at a lower transpulmonary pressure. Without surfactant, alveoli may never inflate or may collapse on expiration and require an inordinate amount of force to re-expand on inspiration, leading to the development of severe RDS and air leak syndromes. Surfactant's secondary function is to enhance macrophage activity and mucociliary clearance, and to reduce inflammation. The incidence of RDS is related more to lung immaturity than to gestational age. However, in general, the more premature the infant, the less the surfactant production and the higher the probability for RDS. Mechanical ventilation is often necessary for the treatment of RDS; however, ventilator-induced lung injury can deactivate the production of

endogenous surfactant production and compromise the therapeutic effect of surfactant replacement therapy. Direct tracheal instillation of surfactant has been shown to reduce mortality and morbidity in infants with RDS.

Exogenous lung surfactant can be either natural or synthetic. Natural surfactant is extracted from animal sources such as bovine or porcine. Synthetic surfactant is manufactured from compounds that mimic natural surfactant properties. Both forms of surfactant replacement are effective at reducing the severity of RDS; however, comparative trials demonstrate greater early improvement in the requirement for ventilatory support and fewer pneumothoraces associated with natural surfactant extract treatment. On clinical grounds, natural surfactant extracts would seem to be the more desirable choice.

Two basic strategies for surfactant replacement have emerged: prophylactic or preventive treatment, in which surfactant is administered at the time of birth or shortly thereafter to infants who are at high risk for developing RDS from surfactant deficiency; and rescue or therapeutic treatment, in which surfactant is administered after the initiation of mechanical ventilation in infants with clinically confirmed RDS.

Prophylactic surfactant administration to infants at risk of developing RDS is associated with lower risk of air leak and mortality, compared to selective use of surfactant in infants with established RDS. Surfactant administration with brief lung-protective ventilation (followed by extubation to nasal continuous positive airway pressure [CPAP]) for premature infants at risk for developing RDS is associated with a lower incidence of mechanical ventilation, air leak syndromes, and chronic lung disease, compared to selective surfactant and continued mechanical ventilation.

Surfactant is traditionally administered by instilling through the endotracheal tube (ETT), but can also be delivered effectively by injection through the nasopharynx during delivery or by using a thin catheter. Experimental evidence also supports the delivery of some surfactants using a nebulizer. Some early promising studies also look at using surfactant as a delivery agent for the administration of steroids directly to the lungs.

Settings

Surfactant is administered by trained personnel in:

- Delivery room
- Intensive care unit (ICU)
- Newborn nursery (if awaiting external transport to ICU)
- Institutions that have the ability to perform neonatal resuscitation and stabilization procedures

Indications

- Prophylactic administration may be indicated in:
 - Premature infants at high risk of developing RDS secondary to surfactant deficiency (e.g., <32 weeks or low birth weight <1,300 g)
 - Infants in whom there is laboratory evidence of surfactant deficiency such as lecithin/sphingomyelin ratio <2:1, bubble stability test indicating lung immaturity, or the absence of phosphatidylglycerol
- Rescue or therapeutic administration may be indicated in preterm or full-term infants who are suspected of having surfactant deficiency by inactivation and
 - Who require endotracheal intubation and mechanical ventilation secondary to respiratory failure and
 - Who require an fraction of inspired oxygen (F_{IO_2}) ≥ 0.40 , and
 - Clinical and radiographic evidence of neonatal RDS or MAS, including:
 - Neonates with mean airway pressure >7 cm H_2O to maintain an adequate partial pressure of oxygen (P_{aO_2}), arterial oxygen saturation, or blood oxygen saturation (S_{pO_2}).
- Surfactants may be used as a vehicle to deliver other drugs such as antibiotics, anti-inflammatory agents, and bronchodilators.
- Postoperative development of acute respiratory distress syndrome (ARDS) following cardiac surgery. The use of exogenous surfactant reduces time on positive-pressure ventilation and reduces the ICU and hospital stay.
- Treatment of severe respiratory syncytial virus-induced respiratory failure with porcine surfactant may improve gas exchange and respiratory mechanics and shorten the duration of invasive mechanical ventilation and hospital stay.

Contraindications

Relative contraindications to surfactant administration are:

- The presence of congenital anomalies incompatible with life beyond the neonatal period
- Respiratory distress in infants with laboratory evidence of lung maturity
- Diagnosis of congenital diaphragmatic hernia. The congenital diaphragmatic hernia study group enrolled 2,376 patients into their registry and found that early use of surfactant (<1 hour post birth) did not alter the odds ratio, when compared with the no surfactant group, and those

with immediate distress receiving surfactant had greater odds of death than the group who did not receive surfactant. Furthermore, it is also plausible that administration of surfactant may cause a clinical deterioration in infants with substantial pulmonary hypoplasia, although further randomized controlled trials are needed to confirm.

- Patient hemodynamically unstable
- Active pulmonary hemorrhage

Hazards/Complications

- Procedural complications resulting from the administration of surfactant include:
 - Plugging of ETT by surfactant
 - Hemoglobin desaturation and increased need for supplemental O₂
 - Bradycardia due to hypoxia
 - Tachycardia due to agitation, with reflux of surfactant into the ETT
 - Pharyngeal deposition of surfactant
 - Administration of surfactant to only one lung (i.e., right mainstem intubation)
 - Administration of suboptimal dose
- Physiologic complications of surfactant replacement therapy include:
 - Apnea
 - Pulmonary hemorrhage from right to left shunting
 - Increased necessity for treatment for patent ductus arteriosus
 - Marginal increase in retinopathy of prematurity
 - Volutrauma resulting from increase in lung compliance following surfactant replacement and failure to change ventilator settings accordingly
 - Hyperventilation from volutrauma (see bullet above) and hypoventilation from plugging of endotracheal tube (ETT) by surfactant, apnea, and increased necessity for treatment for patent ductus arteriosus, both of which can alter blood flow to the brain, leading to further complications.
- Early surfactant therapy strategies increase the number of infants receiving surfactant, leading to more infants exposed to potential risks of intubation, mechanical ventilation, and surfactant administration.

Limitations of Method

- Surfactant administered prophylactically may be given to some infants in whom neonatal RDS would not have developed.
- When surfactant is administered prophylactically in the delivery room, ETT placement may not have been verified by chest radiograph, resulting in the inadvertent administration to only one lung or to the stomach.
- Prophylactic surfactant administration may delay patient stabilization.
- Atelectasis and lung injury may occur prior to therapeutic administration.
- Tracheal suctioning should be avoided immediately following surfactant administration if ventilation can be adequately maintained. Most studies suggest a time period of 1–6 hours following surfactant delivery. Therefore, we recommend using good clinical judgment and tracheal suctioning following surfactant, as needed.
- Not all infants who are treated with a single dose of surfactant experience a positive response, or the response may be transient.
- Positioning recommended for surfactant administration may further compromise the unstable infant.

Assessment of Need

Determine that valid indications are present.

- Assess lung immaturity prior to prophylactic administration of surfactant by gestational age and birth weight and/or by laboratory evaluation of tracheal or gastric aspirate.
- Establish the diagnosis of neonatal RDS by chest radiographic criteria and the requirement for mechanical ventilation in the presence of short gestation and/or low birth weight.

Assessment of Outcome

- Reduction in F_{IO2} requirement
- Reduction in work of breathing
- Improvement in aeration, as indicated by chest radiograph
- Improvement in pulmonary mechanics (compliance, airways resistance) and lung volume (functional residual capacity)

- Reduction in ventilator support (peak inspiratory pressure, positive end-expiratory pressure [PEEP], airway pressure)
- Improvement in ratio of arterial to alveolar P_{O_2} and oxygen index

Resources

Administration procedures recommended for specific preparations of surfactant should be adhered to.

- Equipment:
 - Administration equipment
 - Syringe containing the ordered dose of surfactant, warmed to room temperature or manufacturer's recommendation
 - Appropriate size feeding tube or catheter, ETT connector with delivery port, or closed catheter system
 - Mechanical ventilator with tidal volume monitoring capability
 - Resuscitation equipment
 - Laryngoscope and appropriately sized ETT
 - Manual resuscitator that is capable of providing positive end-expiratory pressure/ continuous positive end-expiratory pressure (PEEP/CPAP), and airway manometer
 - Blended oxygen source capable of delivering F_{IO_2} of 0.21–1.0
 - Suction equipment (i.e., catheters, sterile gloves, collecting bottle and tubing, and vacuum generator)
 - Radiant warmer ready for use as applicable
 - Monitoring equipment
 - Tidal volume monitor, if available (if not within ventilator)
 - Pulse oximeter
 - Cardiorespiratory monitor
- Personnel: Surfactant replacement therapy should be performed by healthcare providers who are proficient at administering surfactant and capable of handling adverse events.
 - Proper use, understanding, and mastery of the equipment and technical aspects of surfactant replacement therapy
 - Comprehensive knowledge and understanding of ventilator management and pulmonary anatomy and pathophysiology
 - Patient assessment skills, including the ability to recognize and respond to adverse reactions and/or complications of the procedure
 - Knowledge and understanding of the patient's history and clinical condition
 - Knowledge and understanding of airway management
 - Ability to interpret monitored and measured blood gas variables and vital signs
 - Proper use, understanding, and mastery of emergency resuscitation equipment and procedures, including intubation
 - Ability to evaluate and document outcome (see section above: Assessment of Outcome)
 - Understanding and proper application of universal precautions

Monitoring

The following should be monitored as part of surfactant replacement therapy.

- Proper placement and position of delivery device and ETT
- F_{IO_2} and ventilator settings
- Reflux of surfactant into ETT
- Position of patient
- Chest-wall movement
- Oxygen saturation by pulse oximetry
- Vital signs
- Pulmonary mechanics and tidal volumes
- Breath sounds
- Following administration, the below may be obtained:
 - Invasive and/or noninvasive measurements of arterial blood gases
 - Chest radiograph

Frequency

In infants at high risk of respiratory distress, a policy of multiple doses of surfactant has resulted in greater improvements regarding oxygenation and ventilatory requirements, a decreased risk of necrotizing enterocolitis, and decreased mortality. The ability to give multiple doses of surfactant to

infants with ongoing respiratory insufficiency appears to be the most effective treatment regimen. Repeat doses of surfactant are contingent upon the continued diagnosis of neonatal RDS. The frequency with which surfactant replacement is performed should depend upon the clinical status of the patient and the indication for performing the procedure. Additional doses of surfactant, given at 6–24-hour intervals, may be indicated in infants who experience increasing ventilator requirements or whose conditions fail to improve after the initial dose.

Currently Available Intratracheal Suspensions

	Trade Name	Source	Manufacturer	Dose	Surfactant Protein B
Poractant alfa	Curosurf	Porcine	Chiesi Farmaceutici	100–200 mg/kg/dose (1.25–2.5 mL/kg)	0.45
Calfactant	Infasurf	Bovine	Ony	105 mg/kg/dose (3 mL/kg)	0.26
Beractant	Survanta	Bovine	Abbott Laboratory	100 mg/kg/dose (4 mL/kg)	<1
Lucinactant	Surfaxin	Synthetic	Discovery Labs	5.8 mL/kg	KL ₄

Currently Available Surfactants

- As of March 6, 2012, lucinactant is the first synthetic peptide-containing surfactant cleared by the Food and Drug Administration (FDA) for use to treat neonatal RDS.
 - When compared in clinical trials, lucinactant, was found to have similar rates of mortality and morbidity as did beractant and poractant alfa.
- A major component of animal derived surfactants (beractant, calfactant, and poractant alfa) is surfactant protein B (SP-B). SP-B has been found to reduce surface tension to a greater extent than surfactant protein-C (SP-C). Congenital absence of SP-B at birth is lethal, while SP-C deficiency is not associated with respiratory failure. Older generation synthetic surfactant preparations did not contain any peptide-chain proteins such as SP-B, which led to the universal practice of using animal derived surfactants, of which all contained variable amount of SP-B protein. Lucinactant has an SP-B mimicking protein called KL₄.
- Current data support the use of natural exogenous surfactant over the use of laboratory derived synthetic surfactant. Natural surfactants have shown superior surface absorption and better lowering of alveolar surface tension. In comparative randomized clinical trials, natural surfactant also showed lower oxygen requirement, lower risks of pneumothorax, bronchopulmonary dysplasia (BPD), and death.
- Synthetic preparations may have better quality control than natural surfactants, due to the batch-to-batch variations in natural surfactants. The purification procedure for natural surfactants includes extraction with organic solvents to remove hydrophilic proteins SP-A and SP-D.
- There is a small concern with the transmission of prion diseases from natural surfactant preparations. There are some cultural and religious concerns with the use of bovine and/or porcine surfactant preparations.

Infection Control

- Universal precautions should be implemented.
- Aseptic technique should be practiced and a close catheter system is preferred.
- Appropriate infection control guidelines for the patient should be posted and followed.

Prophylactic Versus Selective Treatment of RDS

- Early surfactant therapy has the advantage of rapidly establishing normal surfactant levels to the lungs and improving lung mechanics, but it can expose an infant who may not develop RDS to intubation, mechanical ventilation, and expose the infant to a drug that may not be necessary.
- Selective treatment treats only infants with symptoms of RDS, but this technique has the potential to delay surfactant administration and allow the lung inflammation and protein-containing fluid influx to impair gas exchange.
- Prophylactic and early surfactant replacement therapy (within 2 hours of birth) reduces mortality and pulmonary complications in mechanically ventilated infants with RDS, compared to later selective administration.
- A lower treatment threshold of $F_{IO_2} < 0.45$ reduces the incidence of air leak syndromes (pulmonary interstitial emphysema and pneumothorax) and BPD.
- A higher treatment threshold of $F_{IO_2} > 0.45$ is associated with an increased risk of patent ductus arteriosus.
 - There is evidence of as much as a 22 mm Hg change in mean arterial pressure immediately (within 15 min) of administering surfactant, leading to a hemodynamically important ductus arteriosus.
- Early surfactant therapy followed by planned extubation at 1 hour to nasal CPAP significantly reduces the incidence of BPD, compared to selective administration of surfactant.

Developmental Outcomes

- Early treatment of RDS (within 2 hours of birth) to infants <30 weeks gestation was associated with fewer long-term clinical pulmonary complications than assignment to a selective administration group.
- Surfactant replacement therapy (early or selective methods) has been associated with reduced mortality, without any increase in neuro-developmental disability in survivors at 1–2 year follow-up examinations.

Delivery Techniques

- INSURE (Intubation, Surfactant, Extubation)
 - This technique features early surfactant replacement therapy with prompt extubation to nasal CPAP. The technique is associated with less need for mechanical ventilation, lower incidence of BPD, and fewer air leak syndromes, when compared with later, selective surfactant replacement therapy, mechanical ventilation, and extubation from lower ventilator settings.
- Selective surfactant replacement therapy with mechanical ventilation followed by extubation from lower ventilator settings
 - This technique is initiated upon clinical evidence of RDS, such as radiological findings, increased F_{IO_2} requirement, and/or increased work of breathing.
- Pharyngeal instillation before first breath
 - As soon as the infant's head appears on the perineum or at operative incision, the mother stops pushing and the pharynx and stomach are suctioned with a catheter. The surfactant solution is then instilled into the posterior pharynx through a catheter, without direct laryngoscopy. The infant is then stimulated to breathe as soon as the shoulders and rest of the body are delivered. There have been no randomized controlled trials in humans to validate this technique. Animal studies have confirmed improvement of lung expansion and better survival rates.
- Laryngeal mask airway (LMA) administration
 - The LMA has been identified to require less skill to place than a traditional oral or nasal intubation with an ETT. In an animal study comparing ETT to LMA surfactant delivery, it was reported that surfactant delivery could be accomplished sooner in the LMA group with equivalent efficacy. While far from conclusive, this method holds hope for areas in which ETT intubation skills are lacking.
- Bronchoalveolar lavage
 - Bronchoalveolar lavage has shown promise in the treatment of MAS. An animal study conducted by Rey-Santano et al demonstrated that surfactant lavage is a safe and effective alternative treatment for MAS. The synthetic surfactant lucinactant was used, due to its properties to resist inactivation by plasma proteins and oxidants present in inflamed lungs. A human trial conducted by Sinha et al, also using lucinactant, demonstrated that surfactant lavage seemed safe and effective in the treatment of MAS.
- Aerosolized surfactant
 - Although aerosolized surfactant has been studied in the treatment of adult ARDS, no clinical study has shown it to reduce mortality, stay on mechanical ventilation, need for oxygen supplementation, or stay in the ICU.
 - Aerosolized surfactant and nasal CPAP could theoretically allow administration of surfactant without intubation, but the ideal preparation, dose, and route of delivery are still being researched for optimal alveolar delivery.
- In animal studies, distribution of intratracheally instilled surfactant has been largely determined by gravity, and unaffected by the position of the chest. Therefore, leaving the chest in a horizontal position may result in the most even distribution of surfactant to the lungs.

Recommendations

The recommendations below are made following the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) criteria.

- Administration of surfactant replacement therapy is strongly recommended in a clinical setting where properly trained personnel and equipment for intubation and resuscitation is readily available. (1A)
- Prophylactic surfactant administration is recommended for neonatal RDS in which surfactant deficiency is suspected. (1B)
- Rescue or therapeutic administration of surfactant after the initiation of mechanical ventilation in infants with clinically confirmed RDS is strongly recommended. (1A)
- A multiple surfactant dose strategy is recommended over a single dose strategy. (1B)
- Natural exogenous surfactant preparations are recommended over laboratory derived synthetic suspensions at this time. (1B)
- We suggest that aerosolized delivery of surfactant not be utilized at this time. (2B)

Definitions:

Strength of the Recommendations

Level	Strength	Description
1	Stronger	Benefits clearly outweigh the risks and burdens (or vice versa) for nearly all patients.
2	Weaker	Risks and benefits are more closely balanced or are more uncertain

Grade of Quality of the Evidence

Quality of the Evidence		
Grade	Quality	Description
A	High	Well-performed randomized controlled trials or overwhelming evidence of some other sort. Further research is very unlikely to change our confidence in the estimate of the effect.
B	Moderate	Randomized controlled trials that are less consistent, have flaws, or are indirect in some way to the issue being graded, or very strong evidence of some other sort. Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
C	Low	Observational evidence (from observational studies, case series, or clinical experience), or evidence from controlled trials with serious flaws. Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
D	Very Low	Any estimate of effect is very uncertain.

Adapted from: Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, Schünemann HJ; GRADE Working Group. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ 2008;336(7650):924-926.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Pulmonary disease

Guideline Category

Treatment

Clinical Specialty

Obstetrics and Gynecology

Pulmonary Medicine

Intended Users

Physicians

Respiratory Care Practitioners

Guideline Objective(s)

To provide clinical practice guidelines on surfactant replacement therapy in the neonate

Target Population

Term or preterm infants with or at high risk of developing respiratory distress syndrome (RDS) requiring surfactant therapy

Interventions and Practices Considered

Surfactant replacement therapy

Major Outcomes Considered

- Reduction in fraction of inspired oxygen (F_{IO_2}) requirement
- Reduction in work of breathing
- Improvement in aeration, as indicated by chest radiograph
- Improvement in pulmonary mechanics (compliance, airways resistance) and lung volume (functional residual capacity)
- Reduction in ventilator support (peak inspiratory pressure, positive end-expiratory pressure [PEEP], airway pressure)
- Improvement in ratio of arterial to alveolar partial pressure of oxygen (P_{O_2}) and oxygen index

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

The authors searched the MEDLINE, CINAHL, and Cochrane Library databases for English-language randomized controlled trials, systematic reviews, and articles investigating surfactant replacement therapy published between January 1990 and July 2012. By inspection of titles, references having no relevance to the clinical practice guideline were eliminated.

Number of Source Documents

The 2013 update of this clinical practice guideline is based on 253 clinical trials and systematic reviews, and 12 articles investigating surfactant replacement therapy.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Grade of Quality of the Evidence

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Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review

Description of the Methods Used to Analyze the Evidence

Not stated

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The recommendations are made following the Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria.

Rating Scheme for the Strength of the Recommendations

Strength of the Recommendations

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1	Stronger	Benefits clearly outweigh the risks and burdens (or vice versa) for nearly all patients.
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Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for selected recommendations (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Decreased morbidity and mortality in infants due to effective treatment of respiratory distress syndrome with surfactant replacement therapy

Potential Harms

Hazards/Complications

- Procedural complications resulting from the administration of surfactant include:
 - Plugging of endotracheal tube (ETT) by surfactant
 - Hemoglobin desaturation and increased need for supplemental O₂
 - Bradycardia due to hypoxia
 - Tachycardia due to agitation, with reflux of surfactant into the ETT
 - Pharyngeal deposition of surfactant
 - Administration of surfactant to only one lung (i.e., right mainstem intubation)
 - Administration of suboptimal dose
- Physiologic complications of surfactant replacement therapy include:
 - Apnea
 - Pulmonary hemorrhage from right to left shunting
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 - Marginal increase in retinopathy of prematurity
 - Volutrauma resulting from increase in lung compliance following surfactant replacement and failure to change ventilator settings accordingly
 - Hyperventilation from volutrauma (see bullet above) and hypoventilation from plugging of endotracheal tube (ETT) by surfactant apnea, and increased necessity for treatment for patent ductus arteriosus, both of which can alter blood flow to the brain, leading to further complications.
- Early surfactant therapy strategies increase the number of infants receiving surfactant, leading to more infants exposed to potential risks of intubation, mechanical ventilation, and surfactant administration.

Limitations of Method

Surfactant administered prophylactically may be given to some infants in whom neonatal respiratory distress syndrome (RDS) would not have developed.

- When surfactant is administered prophylactically in the delivery room, ETT placement may not have been verified by chest radiograph,

resulting in the inadvertent administration to only one lung or to the stomach.

- Prophylactic surfactant administration may delay patient stabilization.
- Atelectasis and lung injury may occur prior to therapeutic administration.
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- Not all infants who are treated with a single dose of surfactant experience a positive response, or the response may be transient.
- Positioning recommended for surfactant administration may further compromise the unstable infant.

Contraindications

Contraindications

Relative contraindications to surfactant administration are:

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- Respiratory distress in infants with laboratory evidence of lung maturity
- Diagnosis of congenital diaphragmatic hernia. The congenital diaphragmatic hernia study group enrolled 2,376 patients into their registry and found that early use of surfactant (<1 hour post birth) did not alter the odds ratio, when compared with the no surfactant group, and those with immediate distress receiving surfactant had greater odds of death than the group who did not receive surfactant. Furthermore, it is also plausible that administration of surfactant may cause a clinical deterioration in infants with substantial pulmonary hypoplasia, although further randomized controlled trials are needed to confirm.
- Patient hemodynamically unstable
- Active pulmonary hemorrhage

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Patient-centeredness

Identifying Information and Availability

Bibliographic Source(s)

Walsh BK, Daigle B, DiBlasi RM, Restrepo RD. AARC clinical practice guideline. Surfactant replacement therapy. 2013. Respir Care. 2013 Feb;58(2):367-75. [90 references] [PubMed](#)

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1994 Aug (revised 2013 Feb)

Guideline Developer(s)

American Association for Respiratory Care - Professional Association

Source(s) of Funding

American Association for Respiratory Care (AARC)

Guideline Committee

American Association for Respiratory Care Clinical Practice Guidelines Steering Committee

Composition of Group That Authored the Guideline

Authors: Brian K. Walsh, RRT-NPS RPFT FAARC, Respiratory Care Department, Children's Medical Center, Dallas, Texas; Department of Respiratory Care, Rush University, Chicago, Illinois; Brandon Daigle, RRT-NPS, Respiratory Care Department, Children's Medical Center, Dallas, Texas; Robert M. DiBlasi, RRT-NPS, FAARC, Respiratory Care Department, Seattle Children's Hospital, Seattle, Washington; Ruben D. Restrepo, MD, RRT, FAARC, Department of Respiratory Care, The University of Texas Health Sciences Center at San Antonio, San Antonio, Texas

Financial Disclosures/Conflicts of Interest

The authors have disclosed no conflicts of interest.

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: American Association for Respiratory Care (AARC). AARC clinical practice guideline. Surfactant replacement therapy. Respir Care. 1994 Aug;39(8):824-9. [62 references]

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the [American Association for Respiratory Care \(AARC\) Web site](#)

Print copies: Available from the American Association for Respiratory Care (AARC), 9425 N. MacArthur Blvd., Ste. 100, Irving, TX 75063.

Availability of Companion Documents

The following is available:

- Restrepo RD. American Association for Respiratory Care (AARC) clinical practice guidelines: from "reference-based" to "evidence-based." Respir Care. 2010 Jun;55(6):787-9. Available in Portable Document Format (PDF) from the [American Association for Respiratory Care \(AARC\) Web site](#) .

Print copies: Available from the American Association for Respiratory Care (AARC), 9425 N. MacArthur Blvd., Ste. 100, Irving, TX 75063.

Patient Resources

None available

NGC Status

This summary was completed by ECRI on November 30, 1998. The information was verified by the guideline developer on December 15, 1998. This NGC summary was updated by ECRI Institute on July 2, 2013.

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